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A METHOD AND APPARATUS FOR PRODUCING A LIQUID CRYSTAL DISPLAY DEVICE

[Abstract]

PROBLEM TO BE SOLVED: To prevent the occurrence of a gap defect by crushing of elastic bodies interposed between surface plates and substrates in all directions.

SOLUTION: The manufacturing aperture for liquid crystal display device has the upper surface plate 1 and the lower surface plate 2 installed with the planar elastic materials 5 and is capable of bonding two sheets of the upper and lower substrates 3 and 4; at least one of which is subjected to coating application of sealing material and spraying of spacer particle 7 or forming of projection to each other by aligning

these substrates 3 and 4 in the state of vacuum attracting one sheet each to the upper surface plate 1 and the lower surface plate 2 and pressurizing the substrates 3 and 4 by means of both the surface plates 1 and 2. Attraction holes 51 of the elastic materials 5 are disposed to incline with the thickness direction of the elastic materials. As a result, the crushing direction of the elastic materials 5 is controlled and the pressurization onto the panel in bonding can be made uniform.

[Claim(s)]

[Claim 1] A method of producing a liquid crystal display device wherein the method comprises a process of spreading seal material for bonding two substrates and scattering spacer particles or generating projections for providing a gap between said substrates on at least one substrate of said substrates, a process of vacuum-absorbing said substrates respectively, a process of accomplishing an alignment of said substrates, and a process of bonding said substrates, wherein while vacuum-absorbing said substrates, any one substrate of said substrates is in contact with an elastic body and vacuum-absorbed by absorption holes of said elastic body that is inclined to a thickness direction of said elastic body.

[Claim 2] The method of Claim 1, wherein said absorption holes of said elastic body are inclined in the same direction.

[Claim 3] The method of Claim 1, wherein said absorption holes of said elastic body are inclined more than 3° to the thickness direction of said elastic body.

[Claim 4] A method of producing a liquid crystal display device wherein the method comprises a process of spreading seal material for bonding two substrates and scattering spacer particles or generating projections for providing a gap between said two substrates on at least one substrate of said substrates, a process

of vacuum-absorbing said substrates respectively, a process of maintaining degrees of vacuum within an environment including said substrates lower than those at vacuum-absorption of said substrate, a process of accomplishing an alignment of said substrates while maintaining a constant distance between said substrates, and a process of bonding said substrates by pressurizing said substrates and pressing said seal material, characterized in upon vacuum-absorbing said two substrates, any one substrate of said substrates is contacted with an elastic body and vacuum-absorbed by absorption holes of said elastic body that is inclined to a thickness direction of said elastic body.

[Claim 5] The method of Claim 4, wherein said absorption holes of said elastic body are inclined in the same direction.

[Claim 6] The method of Claim 4, wherein said absorption holes of said elastic body are inclined more than 3° to the thickness direction of said elastic body.

[Claim 7] An apparatus for producing a liquid crystal display device wherein the apparatus includes an upper surface plate and a lower surface plate with a plate-shaped elastic body; each of two substrates is vacuum-absorbed on said upper surface plate and said lower surface plate respectively - on at least one substrate of said substrates, seal materials are spreaded and spacer particles are scattered or projections are generated; an alignment of said substrates is

accomplished; and said substrates are boned by pressurizing said substrates by said upper and lower surface plates, characterized in absorption holes of said elastic body are inclined to a thickness direction of said elastic body.

[Claim 8] The method of Claim 7, wherein said absorption holes of said elastic body are inclined in the same direction.

[Claim 9] The apparatus of Claim 7, wherein said absorption holes of said elastic body are inclined more than 3° to the thickness direction of the elastic body.

[Claim 10] An apparatus for producing a liquid crystal display device wherein the apparatus includes a upper surface plate, a lower surface plate with a plate-shaped elastic body, and a chamber in which said upper surface plate and said lower surface plate are located; each of two substrates is vacuum-absorbed on said upper surface plate and said lower surface plate respectively - on at least one substrate of said substrates, seal materials are spreaded and spacer particles are scattered or projections are generated; an alignment of said substrates are accomplished while maintaining a constant distance between said substrates under the condition that said chamber are maintained at lower degrees of vacuum than those at vacuum-absorption of said substrates; and said substrates are bonded by pressurizing said substrates by said two surface plate and pressing said seal materials, characterized in absorption holes of the elastic body are inclined to a

direction of thickness of said elastic body.

[Claim 11] The method of Claim 10, wherein said absorption holes of said elastic body are inclined in the same direction.

[Claim 12] An apparatus of Claim 10, wherein said absorption holes of said elastic body are inclined more than 3° over the direction of thickness of said elastic body.

[Title of the Invention]

A METHOD AND APPARATUS FOR PRODUCING A LIQUID CRYSTAL DISPLAY DEVICE

[Detailed Description of the Invention]

[Field of the Invention]

This invention relates to a method and apparatus for producing a liquid crystal display device.

[Description of the Prior Art]

As a method of producing liquid crystal display device, there are used two methods as follows: Firstly, the first method is a vacuum injection method. As shown in figure 6, on any one substrate of two substrates 3, 4, two substrates 3, 4 are bonded and seal materials 6 for sealing liquid crystal materials are patterned with one to several cracks. Further, spacer particles 7 or projections are generated for maintaining cell gap of a predetermined value on any one substrate of two substrates 3, 4. These two substrates 3, 4 are vacuum-absorbed on an upper surface plate and a lower surface respectively and bonded under the air pressure, and thereafter the seal materials 6 are cured, thereby to create an empty cell. After liquid crystal materials are injected from the one to several cracks (injection hole) of

seal materials within the vacuum chamber in the empty cell, the injection holes are sealed using the seal materials. As such, the liquid crystal display device is assembled.

The second method is a dropping method. On any one substrate of two substrates, two substrates are bonded and seal materials for sealing liquid crystal materials are patterned without joints. Further, spacer particles and projections are generated for maintaining cell gap of predetermined value on any one substrate of two substrates. Any amounts of liquid crystal materials are dropped on any one substrate of two substrates. These two substrates are vacuum-absorbed on the upper and lower surface plates and bonded within the vacuum-absorbed chamber, and then the seal materials are cured. As such, liquid crystal display device is assembled.

In terms of cell gap that is necessary in the liquid crystal display device, it is generally less than ±0.3μm in the case of TN liquid crystal display device and less than ±0.05 μm in the case of STN liquid crystal display device, whereas the plane processing accuracy of the upper and lower surface plate is only ±20 μm. Therefore, with respect to a method of bonding a liquid crystal display device in accordance with the injection method, since it can not pressurize the upper and

lower substrates uniformly, it needs to pressurize the upper and lower substrates uniformly using a pressurize and to press a seal resin at predetermined amounts. By providing an elastic body between the lower surface plate and the lower substrate, it is possible to pressurize the substrates while pressing the seal resin at the predetermined amounts during bonding process.

At this time, because the upper and lower substrates must be held by vacuum-absorbing on the upper and lower surface plate not to disorder an alignment thereof, it is necessary to hollow a vacuum absorption holes in the elastic body that is located between the lower substrate and the lower surface plate.

[Problem(s) to be Solved by the Invention]

However, an inclination of the absorption holes of the elastic body to the surface of the elastic body is irregular, the elastic body is pressurized in every directions upon bonding, and subsequently a pressure applied to panel is irregular, with the result that it induces undesirable cell gaps in a panel after assembling process, and leads to deterioration of a panel quality accordingly.

Therefore, the object of this invention is to provide a method and apparatus for producing a liquid crystal display device that can avoid undesirable cell gaps occurring as a result that the elastic body interposed between the surface plate and the substrate are pressurized in every direction.

[Means for Solving the Problem]

To resolve the above-mentioned problems, a method of producing a liquid crystal display device disclosed in claim 1 comprises a process of spreading seal materials for bonding two substrates and scattering spacer particles or generating projections for providing a gap between the substrates on at least one substrate of the substrates, a process of vacuum-absorbing the substrates respectively, a process of accomplishing an alignment of the substrates, and a process of bonding the substrates, and when vacuum-absorbing the substrates, any one substrate of the substrates is contacted to an elastic body and vacuum-absorbed by absorption holes of the elastic body that is inclined to a thickness direction of the elastic body.

As such, with respect to an injection method which spreads seal materials for bonding two substrates and scatters spacer particles or generates projections for providing a gap between two substrates on at least one substrate of two substrates, and bonds the substrates to create a cell gap, since any one substrate of two substrates is contacted to the elastic body and is vacuum-absorbed by absorption holes of an elastic body that is inclined to thickness direction of the elastic body, it is possible to control the direction in which the elastic body is pressed and to pressurize into panel uniformly upon bonding. That is, because the elastic body is pressed in the inclined direction of the absorption holes, it is possible

to control the pressed direction of the elastic body in advance so that pressurization into panel will be uniform, thereby to prevent gap deterioration from occurring in the panel after assembling process.

According to a method of producing the liquid crystal display device of claim 1 disclosed in claim 2, the absorption holes of the elastic body are inclined in the same direction. As such, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to a method of producing the liquid crystal display device of claim 1 disclosed in claim 3, the absorption holes of the elastic body are inclined more than 3° to the thickness direction of the elastic body. As such, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed, which results in improving cell gap deterioration.

A method of producing a liquid crystal display device disclosed in claim 4 comprises a process of spreading seal materials for bonding two substrates and scattering spacer particles or generating projections for providing a gap between the two substrates on at least one substrate of the substrates, a process of vacuum-absorbing the substrates respectively, a process of maintaining degrees of

vacuum within an environment including the substrates lower than those at vacuum-absorption of the substrate, a process of accomplishing an alignment of the substrates while maintaining a constant distance between the substrates, and a process of bonding the substrates by pressurizing the substrates and pressing the seal materials, and when vacuum-absorbing the two substrates, any one substrate of the substrates is contacted with an elastic body and vacuum-absorbed by absorption holes of the elastic body that is inclined to a thickness direction of the elastic body.

As such, with respect to a dropping method which spreads seal materials for bonding two substrates and scatters spacer particles or generates projections for providing a gap between two substrates on at least one substrate, and vacuum-absorbs the two substrates respectively, since any one substrate of two substrates is contacted to the elastic body and is vacuum-absorbed by absorption holes of the elastic body that is inclined to thickness direction of the elastic body, it is possible to control the direction in which the elastic body is pressed and to pressurize into a panel uniformly upon bonding. That is, because the elastic body is pressed in the inclined direction of the absorption holes, it is possible to control the pressed direction of the elastic body in advance so that pressurization into panel will be uniform, thereby to prevent gap deterioration from occurring in the panel after assembling process.

According to a method of producing the liquid crystal display device of claim 4 disclosed in claim 5, the absorption holes of the elastic body are inclined in the same direction. As such, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to a method of producing the liquid crystal display device of claim 4 disclosed in claim 6, the absorption holes of the elastic body are inclined more than 3° to the thickness direction of the elastic body. As such, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed, which results in improving cell gap deterioration.

An apparatus for producing a liquid crystal display device disclosed in claim 7 includes an upper surface plate and a lower surface plate with a plate-shaped elastic body; each of two substrates is vacuum-absorbed on the upper surface plate and the lower surface plate respectively - on at least one substrate of the substrates, seal materials are spreaded and spacer particles are scattered or projections are generated; an alignment of the substrates is accomplished; and the substrates are boned by pressurizing the substrates by the upper and lower surface plates, and absorption holes of the elastic body are inclined to a thickness direction

of the elastic body.

Such as, with respect to a injection method wherein the apparatus includes a upper surface plate and a lower surface plate with plate-shaped elastic body, seal materials are spreaded and spacer particles are scattered or projections are generated on at least one substrate of two substrates, the substrates are vacuum-absorbed on the upper and lower surface plates respectively, and the substrates are bonded, since the absorption holes of the elastic body are inclined to a thickness of the elastic body, it is possible to control the direction that the elastic body is pressed, and to pressurize into a panel uniformly upon bonding.

According to an apparatus for producing the liquid crystal display device of claim 7 disclosed in claim 8, the absorption holes of the elastic body are inclined in the same direction. As such, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to an apparatus for producing the liquid crystal display device of claim 7 disclosed in claim 9, the absorption holes of the elastic body are inclined more than 3° to the thickness direction of the elastic body. As such, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed, which results in improving

cell gap deterioration.

An apparatus for producing a liquid crystal display device disclosed in claim 10 includes a upper surface plate, a lower surface plate with a plate-shaped elastic body, and a chamber in which the upper surface plate and the lower surface plate are located; each of two substrates is vacuum-absorbed on the upper surface plate and the lower surface plate respectively - on at least one substrate of the substrates, seal materials are spreaded and spacer particles are scattered or projections are generated; an alignment of the substrates are accomplished while maintaining a constant distance between the substrates under the condition that the chamber are maintained at lower degrees of vacuum than those at vacuum-absorption of the substrates; and the substrates are bonded by pressurizing the substrates by the two surface plate and pressing the seal materials, and absorption holes of the elastic body are inclined to a thickness direction of the elastic body.

Such as, with respect to a dropping method wherein the apparatus includes a upper surface plate, a lower surface plate with plate-shaped elastic body, and a chamber in which the upper surface plate and the lower surface plate are located, seal materials are spreaded and spacer particles are scattered or projections are generated on at least one substrate of two substrates, the substrates are vacuum-absorbed on the upper and lower surface plates respectively, and these substrates

are bonded, it is possible to control the direction that the elastic body is pressed, and to pressurize into a panel uniformly upon bonding.

According to an apparatus for producing the liquid crystal display device of claim 10 disclosed in claim 11, the absorption holes of the elastic body are inclined in the same direction. As such, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to an apparatus for producing the liquid crystal display device of claim 10 disclosed in claim 12, the absorption holes of the elastic body are inclined more than 3° to the thickness direction of the elastic body. As such, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed, which results in improving cell gap deterioration.

[Embodiment of the Invention]

The first embodiment of this invention will be described with reference to Figure 1 to figure 4. Figure 1 is a schematic diagram of an apparatus for producing a liquid crystal display device according to the first embodiment of this invention, Figure 2 is a top plane view that illustrates an elastic

body according to this embodiment of the invention, and Figure 3 is a top plane view that illustrates an lower surface plate according to this embodiment of the invention.

As shown in Figure 1 to Figure 3, the apparatus for producing the liquid crystal display device includes a upper surface 1 and a lower surface 2 with plate-shaped elastic body 5, and accomplishes an alignment of two substrates 3, 4 under the condition that they are vacuum-absorbed on the upper surface plate 1 and the lower surface plate 2 respectively, and bonds two substrates by pressurizing both of the surface plates 1, 2, - on at least one substrate of the two substrates, a seal materials 6 are spreaded and spacer particles 7 are scattered. Further, the absorption holes 51 of the elastic body 5 are inclined to a thickness direction of the elastic body. At this time, the lower surface plate 2 is provided with absorption grooves that communicate with the absorption holes.

Subsequently, the method of producing the liquid crystal display device will be described. First, this method prepares an array substrate and a color filter substrate that are formed typically, and each substrate goes through cleaning process, forming process of alignment layer made of polyimide, and prescribed rubbing process.

Next, spacer particles 7 which are made of resin and have particle diameter

of 4.5μm are spreaded on the side of the array substrate, whereas seal resin 6 which is mixed with glass fiber of diameter 5.5 μm is patterned using screen printing on the side of the color filter substrate. At this occasion, the color filter substrate is patterned with injection hole.

Using such array substrate and color filter substrate, a bonding process is performed as follows.

The bonding device performs the bonding process by inserting elastic body 5 between the lower surface plate 2 and the lower substrate 4. The elastic body 5 is made of silicon rubber materials.

The color filter substrate is vacuum-absorbed on the lower surface plate 2 with the elastic body 5 interposed therebetween and the array substrate are vacuum-absorbed on the upper surface plate 1 respectively, an alignment and bonding processes are accomplished for the upper and lower substrates 3, 4, and seal resin 6 is sufficiently pressed at 1.5 ton between the upper and lower surface plate 1, 2. As shown in figure 4(a), set a shows that absorption holes of the elastic body 5 hollows vertically (a thickness direction of elastic body) to surface of the elastic body, and as shown in figure 4(b) to (d), set b, c, and d show they hollow inclined 2, 3, and 4 degrees to a thickness direction of the elastic body, respectively.

Subsequently, after the set a, set b, set c, and set d that finish bonding are extracted from the bonding device, the seal resin 6 is cured by UV irradiation.

After cutting circumferential parts of the substrates in these sets a, b, and c that finish bonding, the liquid crystal display device is provided by filling liquid crystal material by vacuum injection method and sealing the injection hole.

Second embodiment will be now described with reference to Figure 5. Figure 5 is a schematic diagram illustrating an apparatus for producing a liquid crystal display device according to the second embodiment of this invention.

As shown in figure 5, the apparatus for producing the liquid crystal display device includes a upper surface plate 1, a lower surface plate 2 with plate-shaped elastic body 5, and a chamber 9 in which the upper surface plate 1 and the lower surface plate 2 are located, and accomplishes an alignment of two substrates 3, 4 while maintaining a constant distance therebetween under the condition that they are vacuum-absorbed on the upper surface plate 1 and the lower surface plate 2 respectively and the chamber 9 is maintained with a lower degrees of vacuum than those at vacuum-absorbing of the substrate, and bonds two substrates by pressurizing both the surface plates 1, 2 and pressing seal materials 6, - on at least one substrate of two substrates, seal materials 6 are spreaded and spacer particles 7 are scattered. Further, the absorption holes 51 of the elastic body are inclined to

a thickness direction of the elastic body.

Subsequently, the method of producing the liquid crystal display device will be described. First, this method prepares an array substrate and a color filter substrate that are formed typically, and each substrate goes through cleaning process, forming process of alignment layer made of polyimidee, and prescribed rubbing process like the first embodiment.

Next, spacer particles 7 which are made of resin and have particle diameters of 4.5μm are spreaded on the side of the array substrate, whereas UV curing seal resin 6 which is mixed with glass fiber of diameter 5.5 μm is patterned using screen printing on the side of the color filter substrate. At this time, the color filter substrate is patterned without injection hole.

Using such array substrate and color substrate, bonding process is performed as follows.

The bonding process is performed after dropping liquid crystal materials 8 on the color filter substrate. The bonding device performs the bonding process by inserting the elastic body 5 between the lower surface plate 2 and the lower substrate 4 like the first embodiment.

The color filter substrate on which liquid crystals are dropped in advance is vacuum-absorbed on the lower surface plate 2 with elastic body 5 interposed

therebetween and the array substrate are vacuum-absorbed on the upper surface plate 1 respectively, and this vacuum-absorption is performed until the degrees of vacuum within the chamber 9 is 0.5×133.322 to 1.0×133.322Pa (0.5 to 1.0torr). At this occasion, the degree of vacuum at this vacuum-absorption by the upper and lower surface plates 1, 2 is less than 0.1×133.322Pa(0.1torr).

After an alignment of the upper and lower substrates 3, 4 is accomplished while maintaining above degrees of vacuum within the vacuum chamber 9, the substrates are bonded and seal resin 6 is sufficiently pressed at 1.5 ton between the upper and lower surface plate 1, 2. At this occasion, set e shows that the absorption holes of the elastic body 5 hollows vertically to surface of elastic body, and set f, set g, and set j show that they hollow inclined 2, 3, and 4 degrees to the thickness direction of the elastic body, respectively. Shapes of the elastic body 4 in the set e to the set h correspond to Figure 4(a) to 4(d).

Subsequently, after the set e, the set f, the set g, and the set h that finish bonding are extracted from a bonding device, a liquid crystal display device is provided by curing the seal resin 6 by UV irradiation and cutting away circumferential parts of the substrates.

As a comparative example, an array substrate and a color filter substrate are generated like the first embodiment, but bonding is performed as follows.

That is, bonding process in the set i is performed using prior art method. As shown in Figure 6, after the color filter substrate is vacuum-absorbed on the lower surface plate 2 and the array substrate is vacuum-absorbed on the upper surface plate 1, an alignment of the upper and lower substrates 3, 4 (array substrate, color film substrate) is accomplished and then they are bonded.

Subsequently, after the substrate set i that finishes bonding is extracted from the bonding device, seal resin 6 is pressed by performing vacuum packing, and then cured by UV irradiation.

A measurements (100 points in plane) for cell gaps of the liquid crystal display device in such set a to set i are performed. Further, visual measurements for display uniformity are performed by mounting circumferential circuits and performing a panel display. The results are shown in table 1.

[Table 1]

As can be understood from the table 1, it is possible to improve cell gap deterioration if absorption holes of the elastic body hollow inclined more than 3 degrees to a thickness direction of the elastic body.

[Effect of the Invention]

According to the method of producing the liquid crystal display device disclosed in Claim 1 of this invention, with respect to an injection method which

spreads seal materials for bonding two substrates and scatters spacer particles or generates projections for providing a gap between two substrates on at least one substrate of two substrates, and bonds the substrates to create a cell gap, since any one substrate of two substrates is contacted to the elastic body and is vacuum-absorbed by absorption holes of an elastic body that is inclined to thickness direction of the elastic body, it is possible to control the direction in which the elastic body is pressed and to pressurize into panel uniformly upon bonding. That is, because the elastic body is pressed in the inclined direction of the absorption holes, it is possible to control the pressed direction of the elastic body in advance so that pressurization into panel will be uniform, thereby to prevent gap deterioration from occurring in the panel after assembling process. As a result, the invention can provide liquid crystal display device of high quality having uniform cell gap.

According to Claim 2, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to Claim 3, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed.

According to the method of producing the liquid crystal display device

disclosed in Claim 4 of this invention, with respect to a dropping method which spreads seal materials for bonding two substrates and scatters spacer particles or generates projections for providing a gap between two substrates on at least one substrate, and vacuum-absorbs the two substrates respectively, since any one substrate of two substrates is contacted to the elastic body and is vacuum-absorbed by absorption holes of the elastic body that is inclined to thickness direction of the elastic body, it is possible to control the direction in which the elastic body is pressed and to pressurize into a panel uniformly upon bonding. That is, because the elastic body is pressed in the inclined direction of the absorption holes, it is possible to control the pressed direction of the elastic body in advance so that pressurization into panel will be uniform, thereby to prevent gap deterioration from occurring in the panel after assembling process. As a result, the invention can provide liquid crystal display device of high quality having uniform cell gaps.

According to Claim 5, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to Claim 6, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed.

According to the apparatus of producing the liquid crystal display device disclosed in Claim 7 of this invention, with respect to a injection method wherein the apparatus includes a upper surface plate and a lower surface plate with plate-shaped elastic body, seal materials are spreaded and spacer particles are scattered or projections are generated on at least one substrate of two substrates, the substrates are vacuum-absorbed on the upper and lower surface plates respectively, and the substrates are bonded, since the absorption holes of the elastic body are inclined to a thickness of the elastic body, it is possible to control the direction that the elastic body is pressed, and to pressurize into a panel uniformly upon bonding. As a result, this invention can provide liquid crystal display device of high quality having uniform cell gaps.

According to Claim 8, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to Claim 9, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed.

According to the apparatus of producing the liquid crystal display device disclosed in Claim 10 of this invention, with respect to a dropping method wherein

the apparatus includes a upper surface plate, a lower surface plate with plate-shaped elastic body, and a chamber in which the upper surface plate and the lower surface plate are located, seal materials are spreaded and spacer particles are scattered or projections are generated on at least one substrate of two substrates, the substrates are vacuum-absorbed on the upper and lower surface plates respectively, and these substrates are bonded, it is possible to control the direction that the elastic body is pressed, and to pressurize into a panel uniformly upon bonding, with the result that the invention can provide liquid crystal display device of high quality having uniform cell gap.

According to Claim 11, because the absorption holes are inclined in same direction, the directions that the absorption holes of the elastic body are pressed will be uniform.

According to Claim 12, because the absorption holes of the elastic body are inclined more than 3 degrees, it is ensured to control the direction that the elastic body is pressed.

[Description of Drawings]

Figure 1 is a schematic diagram of an apparatus for producing a liquid crystal display device according to the first embodiment of the invention.

Figure 2 is a top plane view that schematically illustrates an elastic body according to this embodiment of the invention.

Figure 3 is a top plane view that schematically illustrates a lower surface plate according to this embodiment of the invention.

Figure 4 is a schematic diagram showing each absorption hole of the elastic body for liquid crystal display device in various degrees

Figure 5 is a schematic diagram illustrating an apparatus for producing a liquid crystal display device according to the second embodiment of this invention.

Figure 6 is a schematic diagram illustrating the case that injection method is applied to method of producing a liquid crystal display device according to prior art.

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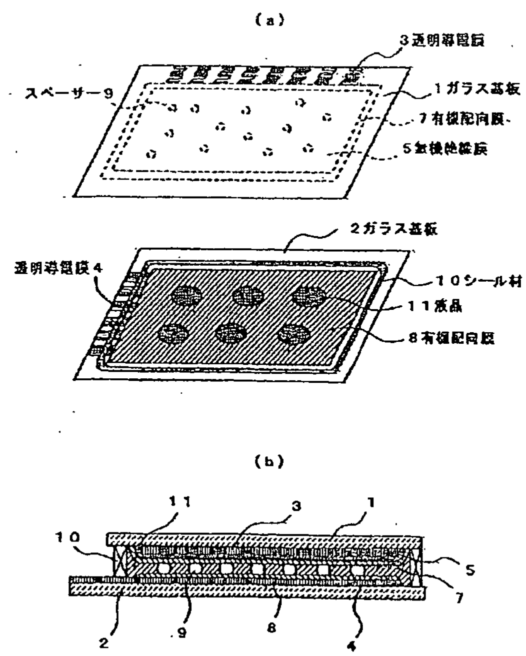
最終頁に続く

(54)【発明の名称】　液晶表示パネルの製造方法

(57)【要約】
【課題】　液晶パネル表示部における表示むらの発生等を防止し、表示品位の向上を図ることができる液晶表示パネルの製造方法を提供する。
【解決手段】　周辺をシール材で囲まれた一対のガラス基板の内面に液晶を滴下充填した液晶表示パネルの製造方法であって、透明導電膜３、無機絶縁膜５、有機配向膜７を順次成膜した第１のガラス基板１と、透明導電膜４上に有機配向膜８を直接成膜した第２のガラス基板２を準備し、第２のガラス基板２に液晶１１を滴下した後、この第２のガラス基板２と第１のガラス基板１とを貼り合わせるものである。



【特許請求の範囲】

【請求項1】 周辺をシール材で囲まれた一対のガラス基板の内面に液晶を滴下充填した液晶表示パネルの製造方法であって、透明導電膜、無機絶縁膜、有機配向膜を順次成膜した第1のガラス基板と、透明導電膜上に有機配向膜を直接成膜した第2のガラス基板を準備し、前記第2のガラス基板に液晶を滴下した後、この第2のガラス基板と前記第1のガラス基板とを貼り合わせることを特徴とする液晶表示パネルの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は液晶表示パネルの製造方法、特に、液晶パネル表示部への液晶滴下による表示むらを防ぐことができる液晶表示パネルの製造方法に関するものである。

【0002】

【従来の技術】液晶ディスプレイ（以下ＬＣＤという）は液晶分子の特定な初期分子配列を電場印加などの作用で他の分子配列状態に変化させ、この分子配列に伴う液晶セルの光学的性質の変化を利用して画像表示させるもので、他の表示素子に比べて薄型、軽量であり、低電圧、低電力で動作するなどの利点を兼ね備えていることから、パソコンに代表されるＯＡ分野から、家電、産業機器の分野に至るまで多岐にわたって使用されている。特に、ＯＡ分野におけるＬＣＤ市場においては、高精細化、大容量化、大画面化などにより画像表示むらのない均一な表示が求められている。

【0003】現在、ＬＣＤ市場では、単純マトリクス方式のＳＴＮ（Ｓｕｐｅｒ Ｔｗｉｓｔｅｄ Ｎｅｍａｔｉｃ）形ＬＣＤと、アクティブマトリクス方式のＴＦＴ（Ｔｈｉｎ Ｆｉｌｕｍ Ｔｒａｎｓｉｓｔｏｒ）形ＬＣＤがある。例えば、ＳＴＮ形ＬＣＤでは、複屈折性と光の旋光性を利用したもので、液晶分子に3°～8°程度のプレチルト角を持たせ、２枚の基板間で液晶分子の配向方向を１８０°～２７０°捻ることで著しく急峻なしきい値特性を得ることを可能にしているが、むらのない均一な表示を得るためには、いかに液晶の分子配向を乱さないようにするかが重要である。

【0004】従来、この液晶表示パネルを製造する方法としては、一般的に次のような２つの方法が提案されている。一つは、対向配置された電極を有するガラス基板を表示セル領域を囲むように一部開口部を設けたシール材で接着固定し、セル構造の空のパネルを作り、液晶を開口部より毛細管現象と圧力差を利用した真空注入法により充填させる方法である。もう一つは、上記の真空注入方法に対し、液晶を充填させるのに要する時間を大幅に短縮することができる液晶滴下組立方法、例えば、特開昭６２−８９０２５号公報に示される方法があり、以下、これについて図面を参照しながら説明する。

【０００５】図2は従来の液晶表示パネルの製造方法における製造工程の説明図であり、前記公報に開示されているものである。

【０００６】この液晶滴下組立方法による液晶表示パネルの製造方法は、図２（ａ）に示すように対向配置された導電膜を有するガラス基板１，２において、ガラス基板１の透明導電膜３上に無機絶縁膜５と有機配向膜７を成膜すると共に、ギャップ保持のためのスペーサー９を配置し、ガラス基板２の透明導電膜４上に無機絶縁膜６と有機配向膜８を成膜すると共に、表示セル領域を囲むシール材１０を形成してシール材１０で囲まれた部分に液晶１１を所定量滴下し、減圧下で貼り合わせて液晶表示パネルを得るものである。図２（ｂ）はガラス基板１，２の貼り合わせ後の断面形状を示し、図２（ｃ）は同平面形状を示している。

【０００７】

【発明が解決しようとする課題】しかしながら、このような方法では、液晶表示パネルの上下ガラス基板１，２間のショートを防止するために、上下ガラス基板１，２表面の透明導電膜３，４の上に、無機絶縁膜５，６を設けているために、液晶を滴下したところの有機配向膜８に発生する誘電分極の電荷により液晶滴下形状のむらが残りやすく、液晶表示パネルの特性低下や図２（ｃ）に示す表示むら領域１２が発生しやすいので、これを防止するために、液晶を封入後、熱処理して対処しているものの、上記液晶滴下形状のむらを完全に消すことができないものも多く、歩留まりの悪化を招くという問題点があった。

【０００８】本発明は上記従来の問題点を解決するものであり、液晶パネル表示部における表示むらの発生等を防止し、表示品位の向上を図ることができる液晶表示パネルの製造方法を提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明の液晶表示パネルの製造方法は、周辺をシール材で囲まれた一対のガラス基板の内面に液晶を滴下充填した液晶表示パネルの製造方法であって、透明導電膜、無機絶縁膜、有機配向膜を順次成膜した第１のガラス基板と、透明導電膜上に有機配向膜を直接成膜した第２のガラス基板を準備し、前記第２のガラス基板に液晶を滴下した後、この第２のガラス基板と前記第１のガラス基板とを貼り合わせるものである。

【００１０】本発明によれば、有機配向膜のみの基板上に液晶を滴下をすることにより、滴下したところの有機配向膜に発生する誘電分極の電荷を容易に逃がすことができるので、液晶滴下形状のむらの発生を抑え、安定した液晶の分子配向を保つことができ、表示部における表示品位の向上を図ることができる。

【００１１】

【発明の実施の形態】以下、本発明の一実施の形態について、図面を参照しながら説明する。なお、前記従来の